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ABSTRACT

This study's purpose was to explore the premise that increasing state support for elementary/secondary schools increases equal student access to educational opportunity. Following a brief overview of the background of the problem, including a description of the so-called "Minnesota Miracle" or Omnibus Tax Law of 1971 with its provisions for property tax relief and increased state educational aid, the authors further define the question under investigation and describe the study's limitations. The next section summarizes the design of the study in terms of population and sampling, sources of data, and treatment of data. Having drawn 10 random samples of independent Minnesota school districts for each year from 1969-70 to 1977-78 in order to monitor the impact of the 1970-71 Minnesota school finance reform, the authors collected and analyzed data descriptive of the service capability of three program aggregates (kindergarten, grades 1-6, and grades 7-12), and five subject areas (English, mathematics, foreign language, natural science, and social science). Results, as indicated in five tables, generally support the hypothesis that an increased percent of the state share of funding increases equal access to educational opportunity. (JBM)

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State Centralization and Equal Access to Educational Opportunity

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State Centralization and Equal Access
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INTRODUCTION

The purpose of the study was to explore the premise that increasing the state share of support for elementary/secondary schools increases equality of student access to educational opportunity. Study activities are reported in sections dealing with a) an introductory overview, b) design of the study, c) results of the study and d) conclusions and implications for further research. By way of introduction this section provides background, defines the problem and lists limitations of the study.

Background of the Problem

During the decade of the 1960's the difference between the state adjusted expenditure per weighted pupil unit and the state foundation aid formula allowance became progressively larger. Local school districts accommodated the differences between rising operational costs and lagging state revenue shares through increased local property tax levies. A property tax payer revolt became the driving force benind Minnesota school finance reform in 1970-71. Equalization of educational opportunity sought in Van Dusartz vs. Hatfield became a companion issue to property tax relief.

The Omnibus Tax Law of 1971, heralded and perhaps mislabeled as the "Minnesota Miracle," provided property tax relief by limiting local district taxing authority and providing an increased proportion of revenue primarily

from state-collected income and sales taxes. Wide differences in district average expenditures per pupil remained after passage of the Omnibus Tax Law, supported by "grandfather" excess levy provisions for high cost, high wealth districts and AFDC concentration aid for the high cost districts serving inner city communities. Subsequent amendments brought low spending districts up to the state average over a six year period 1973-1979 (leveling up), maintained the grandfather excess levy, incrementally increased the formula allowance, adjusted the local property tax share, and compensated for declining enrollment.[1]

One important effect of the legislation was to make the state the senior partner in the state-local partnership for finance of elementary/secondary education. These changes were initiated and continued amid a national climate of school finance reform. In spite of definitional problems, equality of educational opportunity was a central theme in the school finance reform of the 1970's. State centralization of school finance systems was the primary means to compensate for wealth inequity among school districts.[2]

Minnesota fit the centralization pattern with state share of school revenue increasing across the study period. In 1976 the Minnesota State Planning Agency sought to develop a system for monitoring the effects of state policy on local school districts. Service capability was developed to measure level and change in educational programs available to students.

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[1] For more information see Betsy Levin and Thomas Muller, The Financing of Schools in Minnesota. An Urban Institute Paper. Washington, D.C.: The Institute, 1973. And Tim L. Mazzoni, Jr., State Policy Making for the Public Schools of Minnesota. An Educational Governance Project Report. Ohio State University: The Project, 1974.

[2] See Betsy Levin, Future Directions for School Finance Reform. Lexington: D.C. Heath, 1974.

It was a standardized pupil teacher ratio (full time equivalent licensed staff per 1000 students) that could be used for comparison between grade levels, subject areas, districts, etc. across time. While little policy attention has been directed toward the relationship between revenue or expenditure and access to educational programs, the means for such inquiry were available.[3]

Statement of the Problem

The problem addressed by the study was whether or not increasing the state share of revenue for elementary/secondary education (and at the same time increasing the level of support) resulted in increased program equity in terms of student access to instructional services. The authors' research hypothesis was that both increased state revenue share and increased revenues available would tend toward more equal access to educational opportunity. With considerable risk of oversimplification, the problem was further defined and limited by the following research questions:

1) What is the relationship between the percent state revenue share for elementary/secondary schools and the variance in service capability for kindergarten, grades 1-6, grades 7-12 and secondary subject areas of English, mathematics, foreign language, natural science and social science in a 10 percent stratified random sample of Minnesota school districts during the period 1969-70 through 1977-78?

2) What is the relationship between the CPI adjusted total revenue per student in grades K-12 and the variance in service capability for kindergarten, grades 1-6, grades 7-12 and secondary subject areas of English,

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[3] Minnesota State Planning Agency. A Descriptive Study of Service Capability in a Stratified Random Sample of Minnesota School Districts 1969-70 through 1975-76, State Finance Policy Study #7. St. Paul: The Agency, 1977.

mathematics, foreign language, natural science, and social science in a 10 percent stratified random sample of Minnesota school districts during the period 1969-70 through 1977-78?

Limitations of the Study

1) Results of the study are based on sample (N=43) data. The sample is representative of Minnesota school districts (except that a district serving an inner city community is not included) but may not be representative of school districts in terms of where most students attend school.

2) Statistical tests were used primarily as a guide to decision rules, but there was no known way to accurately estimate probabilities of Type I and Type II errors.

3) Teacher assignment data for 1978-79 through 1982-83 were available but could not be incorporated into the analysis because of a) changes in the state management information system and b) retrenchment of resources for computer programming to compensate for the change.

4) The Consumer Price Index (CPI) was used to adjust actual dollar amounts to compensate for inflation across the time period. The CPI is based on a service and commodity cluster mix that may be different from goods and services purchased by school districts.

DESIGN OF THE STUDY

The design of the study is summarized in the following sections dealing with a) population and sampling, b) sources of data and c) treatment of data.

Population and Sampling

The population consisted of all Minnesota independent school districts operating during 1977-78. The sample was drawn by the authors in 1976

for other studies monitoring the impact of the 1970-71 Minnesota school finance reform. Districts were stratified on enrollment size, taxable wealth, expenditure level and enrollment trend and categorized as follows:

a) large or small if they served more or fewer than 1,317 (33rd percentile) resident weighted pupil units in average daily attendance (WADA) during 1969-70,

b) high or low wealth if their 1967 adjusted assessed valuation per WADA was above or below $8,340 (median),

c) high or low expenditure if expenditure per weighted average daily membership (WADM) was more or less than $663 (state average), and

d) growing, stable or declining if K-12 enrollment from 1970-71 through 1974-75 increased 6 percent or more, did not fluctuate more than plus or minus five percent or decreased six percent or more, respectively. A computer program was used to place 426 districts into 24 cells and draw a 10 percent random sample from each cell with districts subject to replacement if they did not offer grades K-12, if they operated a post-secondary area vocational technical institute (data contamination) or if they were involved in reorganization that increased enrollment more than 5 percent over any preceding year.[4] The original sample of 45 districts was reduced to 43 for the present study due to reorganization.

Sources of Data

All of the following data used in the study were obtained for each sample district from the files of the Minnesota Department of Education for fiscal years 1970 through 1978:

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[4] Minnesota State Planning Agency, Development of a System for Monitoring the Achievement of State-Level Educational Governance/Management Policy Goals. Mimeographed Report. St. Paul: The Agency, 1977, pp. 11-13.

a) local property tax collections for operating expense (general and transportation funds),

b) state aid transfer payments recognized as revenue in general and transportation funds (primarily foundation, special education, transportation and property tax relief aids),

c) federal aids for operating expenses but excluding federal food service aids,

d) fall enrollment by grade level by district,

e) six-digit subject matter assignment code, grade level, periods-per-week, and teacher and district identification data for each teacher employed in the sample districts during each year of the study period.

Treatment of Data

Treatment of the data were accomplished in the following steps:

1) Local, state and federal revenue amounts for each sample district were adjusted using the Consumer Price Index (CPI) for Minnesota which was "reaveraged" to correspond to the July 1 through June 30 fiscal year. The CPI adjustment was made to minimize distortion of the relationship between revenue per pupil and service capability over time due to inflation. Total CPI adjusted district revenue was divided by total enrollment in grades K-12 to yield a total CPI adjusted revenue per student (independent variable #1) per year. CPI adjusted district revenue from state sources was divided by total revenue to yield percent state share (independent variable #2).

2) A special computer program generated service capability statistics for sample districts in the following steps:

a) Six-digit licensed staff assignment codes are aggregated into program categories, i.e., kindergarten, English, etc. by district.

b) Program aggregates of licensed staff assignments are converted to FTE through a series of decision rules applied to number of periods taught or assigned per week in each program category.

c) Aggregated enrollments associated with personnel assignments, i.e., elementary, secondary, etc., by district by year are used to compute the number of FTE staff per 1000 students by program category.

Service capability data descriptive of three program aggregates (kindergarten, total elementary grades 1-6 and total secondary grades 7-12) and five specific subject areas (English, mathematics, foreign language, natural science and social science) were selected for inclusion in the study analysis.

3) Ten random samples of districts (N=4) were drawn from the initial sample (N=43) for each of the nine years. Sampling was done without replacement and the N=4 sample districts were allowed to be different in each year. For each N=4 sample, a variance was computed on the eight service capability measures and the natural logarithm was obtained for each sample variance. Means for the two independent variables (total CPI adjusted revenue per student and percent state revenue share) were also computed for each of the samples. This procedure suggested by Toothaker[5] and used previously by the authors[6] results in linearized variances that can be subjected to traditional general linear model analytic techniques such as regression and factorial analysis of variance.

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[5] Larry Toothaker, J. Hicks and J. Price. "Optimum Subsample Sizes for the Bartlett-Kendall Homogeneity of Variance Test," Journal of American Statistical Association. Vol. 73 #361, March, 1978, pp. 53-57.

[6] Vernon L. Hendrix and Charles Sederberg. Correlates of Change in Pupil Unit Expenditure Variability. Paper presented at AERA, Los Angeles, 1981.

4) For each dependent variable (service capability) a regression model was computed. This regression model contained the two independent variables (CPI adjusted revenue per student and percent state revenue share), a product of these to allow for interaction, and nine dummy variables to control for variation associated with each year. The nine dummy variables were "forced" to control for this source of variation. The two independent variables and interaction vector were then added.

RESULTS OF THE STUDY

The first three columns of revenue data in Table 1 present mean actual revenue and CPI adjusted revenue per student and average percent state share for the N=43 sample districts by year. The remaining three columns present means and percent state share computed from the ten samples (N=4) drawn for each year. These data indicate that 1) actual and CPI adjusted revenue per student increased each year, 2) percent state share of revenue per student increased, from about 54 percent before the school finance reform of 1970-71 to about 72 percent by 1972-73 with downward fluctuations in 1973-74 and 1977-78. Available population data verify the general funding pattern indicated by the sample data.

Table 2 presents the actual variances of selected service capabilities (dependent variables) for each year in the N=43 sample of districts. The study assumed that reduction of variability in service capability indicated greater equality in access to educational program opportunity across the state. The data in Table 2 indicate that 1) kindergarten service capability variance fluctuated markedly, 2) total grades 1-6 service capability was relatively stable during early years, dropped during 1973-74 and 1974-75 and increased markedly during the last three years, 3) total regular

Table 1

Mean Actual and CPI Adjusted Revenue Per Student and Percent State Share for Sample (N=43) Minnesota Districts and for Ten Samples (N=4) Drawn from the Original Sample by Year During the Period 1969-70 Through 1977-78

	Sample of 43 Districts			Ten Samples (N=4)		
Fiscal Year	Actual	CPI Adjusted	Percent State	Actual	CPI Adjusted	Percent State
1970	$ 675.64	$ 675.64	53.82	$ 667.32	$ 667.32	54.16
1971	775.62	720.40	56.15	772.67	717.66	56.10
1972	887.33	798.09	60.74	875.35	787.32	60.97
1973	996.22	863.13	72.19	995.51	862.52	71.72
1974	1219.82	975.33	62.65	1222.24	977.26	62.57
1975	1032.76	743.72	72.61	1031.37	742.72	72.07
1976	1171.57	782.22	72.01	1178.20	786.65	71.31
1977	1300.60	823.74	72.00	1297.97	822.07	71.92
1978	1478.60	865.31	65.35	1486.27	869.80	65.20

Table 2

Variance of Selected Service Capability Statistics From a Sample (N=43) of Minnesota School Districts by Year During the Period 1969-70 Through 1977-78

Fiscal Year	Kinder-garten	Elem. Grades 1-6	Regular Secondary	English	Math	Foreign Lang.	Nat. Sci.	Social Sci.
1970	199.00	74.50	202.20	16.50	7.50	1.60	6.30	13.60
1971	107.80	67.90	218.40	13.20	7.50	1.40	10.20	10.90
1972	156.80	87.50	189.70	12.60	5.40	1.00	5.00	9.50
1973	63.30	89.50	78.10	1.50	1.50	0.70	1.60	3.30
1974	248.90	47.80	64.00	2.00	1.20	0.60	1.20	3.20
1975	281.00	48.20	64.80	3.30	1.50	0.60	1.30	2.30
1976	88.00	70.00	46.80	3.50	3.30	0.50	1.80	2.60
1977	109.20	113.90	75.30	4.20	1.70	0.50	1.90	2.30
1978	199.10	128.60	61.40	4.40	3.50	0.50	1.30	1.80

secondary instruction service capability variance dropped sharply after the 1970-71 school finance reform and then remained relatively stable, and 4) the pattern in five selected secondary subject matter areas was similar to that for total regular secondary instruction.

Table 3 presents the natural logarithms for the variances reported in Table 2. This table's purpose is comparative in that it shows the extent of anticipated reduction in fluctuation due to linearization of the variances. For example, the ratio of largest to smallest kindergarten service capability variance in Table 2 was approximately 3 to 1; linearization reduces the ratio to approximately 5 to 4.

The mean natural logarithms of the ten N=4 sample service capability variances generated in Step 3 described in the treatment of data section are presented in Table 4. When these data are compared with those in Table 3, two conditions are noticeable. First, the fluctuations across years are relatively greater and can only be attributed to the random sampling process. Using a radio receiver analogy, it can be said that the analytical technique introduces additional "noise" into the system, resulting in a lower signal to noise ratio. It is a "cost" of transforming the data to use an appropriate analytical technique. The end result is a more conservative statistical test. Secondly, the means in Table 4 are generally smaller than the means in Table 3. The lower values are probably the result of sampling variation from essentially non-normal distributions.

Results of statistical tests conducted to address the research questions are summarized in Table 5. The regression coefficients in columns 2 and 3 indicate the magnitude and direction of the relationship between 1) percent state revenue share and 2) CPI adjusted revenue per student (independent variables) and variability in the selected service capability measures

Table 3

Natural Logarithms of Variance of Selected Service Capability Statistics From a Sample (N=43) of Minnesota School Districts by Year During the Period 1969-70 Through 1977-78

Fiscal Year	Kinder-garten	Elem. Grades 1-6	Regular Secondary	English	Math	Foreign Lang.	Nat. Sci.	Social Sci.
1970	5.29	4.31	5.31	2.80	2.01	0.47	1.84	2.61
1971	4.68	4.22	5.39	2.58	2.01	0.34	2.32	2.39
1972	5.05	4.47	5.25	2.53	1.69	0.00	1.61	2.25
1973	4.15	4.49	4.36	0.41	0.41	-0.36	0.47	1.19
1974	5.52	3.87	4.16	0.69	0.18	-0.51	0.18	1.16
1975	5.64	3.88	4.17	1.19	0.41	-0.51	0.26	0.83
1976	4.48	4.25	3.85	1.25	1.19	-0.69	0.59	0.96
1977	4.69	4.74	4.32	1.44	0.53	-0.69	0.64	0.83
1978	5.29	4.86	4.12	1.48	1.25	-0.69	0.26	0.59

Table 4

Mean Natural Logarithms of Selected Service Capability Variances From Ten Samples (N-4) Drawn From a Sample (N=43) of Minnesota School Districts by Year During the Period 1969-70 Through 1977-78

Fiscal Year	Kinder-garten	Elem. Grades 1-6	Regular Secondary	English	Math	Foreign Lang.	Nat. Sci.	Social Sci.
1970	2.47	0.88	3.19	2.00	1.47	1.42	1.66	1.13
1971	1.75	1.03	1.26	2.51	0.75	0.87	3.88	0.49
1972	3.66	1.36	1.77	1.49	0.79	1.73	1.39	4.18
1973	2.14	2.30	0.66	0.57	0.75	1.12	0.23	1.25
1974	2.70	1.64	1.55	0.81	1.85	0.64	2.23	1.54
1975	3.39	0.70	0.63	1.66	0.67	0.54	0.95	1.49
1976	0.89	1.87	0.92	1.52	1.75	0.51	1.66	1.21
1977	1.21	1.82	1.33	2.18	0.81	1.14	1.49	1.39
1978	2.07	1.09	1.23	1.47	3.06	1.07	0.22	2.93

Table 5

Regression Coefficients of Mean Natural Logarithms of Variances of Service Capabilities (Ref. Table 4) Regressed on Percent State Revenue Share and CPI Adjusted Revenue Per Student and R^2 Indicating Proportion of Variance Accounted for by Regression Equations

Service Capability	Regression Coefficients: Percent State Revenue	Regression Coefficients: CPI Adjusted Revenue Per Student	R^2 With Years and Independent Variables	R^2 With Independent Variables Only
Kindergarten	-0.56*	-.003	.11	.03
Elementary	-0.63***	-.004*	.19	.03
Secondary	-0.56**	0	.20	.13
English	+.009	+.001	.27	.16
Mathematics	-.249*	-.018*	.33	.24
Foreign Language	-.055***	0	.28	.16
Natural Science	-.027	+.003	.25	.15
Social Science	-.035	-.001	.22	.17

***Significant at .01

**Significant at .05

*Significant at .10

(dependent variables). The multiple R^2 values in columns 4 and 5 indicate proportions of explainable variance.

Negative regression coefficients between percent state revenue share and a service capability variance indicates that as the percent state share increases, variability in service capability (student access to licensed professional staff) decreases. Similarly, a negative regression coefficient between CPI adjusted revenue per student and a service capability variable indicates that as revenue per student increases, variability in service capability decreases. For relationships between percent state revenue share and service capability variance, 8 of the 9 coefficients were negative. Two were significant at the .01 level, one at the .05 level and two at the .10 level, but interpretations of these results must bear in mind that the probability of a Type I error could not be exactly specified. The one positive regression coefficient is not significant. Four of the 9 regression coefficients measuring the relationship between total revenue per student were negative and two were significant at the .10 level. There were no significant interactions between percent state revenue share and total CPI adjusted revenue per student and the results were omitted from Table 5.

Step 4 in the treatment of data section indicated that "dummy variables" were used to control for variation associated with each year. The R^2 values in columns 4 and 5 estimate the relative predictability of changes in service capability variance. Column 4 presents the multiple R^2 values (which can be interpreted as the proportion of explainable variance) using the complete regression model that included the dummy variables for years and the independent variables. These values are generally low, but the explainability appears to be stronger in some subject areas than in others. Column 5 presents the R^2 values attributable to just the independent variables.

These are consistently smaller, and the proportion of the explainable variance that can be attributed to the independent variables differs quite drastically across the service capability areas. For example, approximately 16 percent of the admittedly small explainable variance for elementary service capability can be attributed to the independent variables of percent state revenue and total adjusted revenue per student. This proportion rises to 65 percent for secondary service capability, 73 percent for secondary mathematics service capability, and 77 percent of secondary social science service capability.

CONCLUSIONS AND IMPLICATIONS FOR FURTHER STUDY

Based on the results of the study the following conclusions were drawn:

1) The negative correlations between percent state revenue share and selected service capability variances reported in Table 5 support confidence in accepting the hypothesis that increased and sustained higher percent state share of funding for elementary/secondary education increased comparable access to educational opportunity in Minnesota public school districts during the period 1969-70 through 1977-78.

2) The general relationship between percent state revenue share and variation in access to educational program varied among the selected service capability measures. The relationship appears more certain for the aggregate service capabilities (kindergarten, elementary, and secondary) than for the subfields at the secondary level. Mathematics and foreign language appear to be more sensitive to changes in percent state revenue than English. This may be due to the consistently higher service capability levels because English is required at all grade levels. Although the direction of the relationships between percent state revenue and natural science and social science service capability variances are as hypothesized, the strength of the relationships are less certain.

3) The regression coefficients in Table 5 tend to indicate that as more total CPI adjusted revenue per student was made available to Minnesota elementary/secondary districts during 1969-70 through 1977-78 that equity in access to educational program opportunity among Minnesota school districts increased. This relationship exists at a lower level of certainty and with greater differential effects across service capability (subject matter) areas.

4) The effects of the Minnesota school finance reform of 1970-71 served to reduce variability in access to instructional services among Minnesota school districts during the period 1969-70 through 1977-78.

Implications for further study include the following:

1) The study should be replicated using all districts in the state and include those years (1980-81 through 1982-83) when Minnesota experienced a severe fiscal crisis that impacted both amount and source level of revenue for elementary/secondary education.

2) The scope of the study might be expanded to analyze levels of service capability relative to variability. The research question might address how much reduction in variability is attributable to increased service in "low service level" districts, reduced service in "high service level" districts or enrollment decline.

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